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Business models for sustainable consumption in the circular economy: An expert study

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ABSTRACT

Combining sustainable consumption with the circular economy concept could help tackle challenges, such as resource scarcity and climate change by reducing resource throughput and increasing cycling of products and materials within the economic system, thereby reducing emissions and virgin material use. To achieve sustainable consumption in a circular economy production and consumption practices need to change. Business models can potentially influence both practices as it defines how a company conducts business and shapes the company-consumer relationship. This paper developed future business models for sustainable consumption through two rounds of semi-structured interviews with experts from academia, industry, and policy. During the first interview round, four business model elements that are important for sustainable consumption were identified: *Resource strategy, Revenue model, Consumer effort,* and *Objective to (decrease/increase) consumption level*. Based on these elements, we developed a comprehensive business model framework. Using this framework, experts envisioned future business models for sustainable consumption of clothing during the second interview round. The findings of this study suggest that the most promising business models for sustainable consumption are those that reduce overall consumption levels and consumer effort. Further, we found that a diverse range of business models in the market can potentially enable different customer segments to consume sustainably.

1. Introduction

Current challenges, such as climate change and resource scarcity (UN, 2017a), are expedited by consumption and development patterns. The population and affluence predicted for 2050, would require three planets if current consumption practices are extrapolated (UN, 2017b). To counter this, it is no longer sufficient for companies to maintain the status quo through incremental business model changes - business practices need to change to sustain companies in the long term and to meet consumers' expectations of conducting business more sustainably (Porter and Kramer, 2011).

The circular economy (CE) is an increasingly popular approach to create sustainable business. The aim of a CE is to attain a sustainable society and economy by avoiding and minimizing resource consumption through multiple product and material loops (EMF, 2015). However, there are many different definitions of the CE (Kirchherr et al., 2017) and a common understanding of what is considered a circular business models is only gradually emerging (e.g., Lewandowski, 2016; Bocken et al., 2016). This may be due to the different concepts united under the term CE (Blomsma and Brennan, 2017) and a manifold of different 'circular' business cases in practice (Guldmann, 2016). The CE field is an emerging research field, and so far, the focus has widely been on materials and the company side of circularity (Guldmann, 2016; Whalen, 2017).

Sustainable consumption (SC) patterns are necessary to realize a sustainable society and economy (Druckman and Jackson, 2010). SC entails satisfying consumer needs while reducing negative impacts caused during material extraction, production and consumption (Mont and Plepys, 2008; Cooper, 2013). In the CE, companies are potential enablers of SC through changing production processes and consumption patterns by satisfying consumer needs in new ways, through new business models (Bocken, 2017). In the last decades, some forms of sustainability-focused companies have

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emerged. An example is the 'Benefit Corporation', a specific type of company certified to purposely generate positive impact for stakeholders, the environment and society as part of its corporate structure (B Lab, 2018).

We applied a Delphi-inspired approach (Dalkey and Helmer, 1963) with expert interviews to explore how business models and their elements can lead to SC in the CE. During the first round of expert interviews, we identified relevant business model elements that experts combined to business models for sustainable consumption in the clothing industry in the second interview round. This study represents a step towards exploring the role of business models for SC in the transition to the CE. Contributing to the literature by combining the streams of sustainable business models (e.g., Boons and Lüdeke-Freund, 2013; Bocken et al., 2014) and SC (e.g., Mont and Plepys, 2008; Cooper, 2013) in the CE context, and supporting practitioners by providing a framework to develop and discuss business models for SC.

2. Literature background

2.1. Inducing sustainable consumption

Consumption in developed countries is dominated by ever shorter product use and lifetimes, catalyzed by a throwaway culture (Cooper, 2013). In order to achieve the goal of the CE, a sustainable society and economy, this trend needs to be reversed - SC is needed (Druckman and Jackson, 2010; Bocken et al., 2016). The United Nations grasp SC and production as "doing more and better with less" (UN, 2017b). The literature presents definitions of SC emphasizing impact reduction or an absolute reduction of consumption (Mont and Plepys, 2008), or focus on simultaneously achieving societal well-being and resource efficiency (Tukker et al., 2006). Integrating these definitions, this paper defines SC as *shaping and satisfying consumer needs to continuously reduce negative impacts of consumption on the environment and the wider society*. SC thus includes sustainable use and requires sustainable production.

For a CE, different options to induce SC in the consumer market have been suggested. These options include marketing and communication-based approaches (Chamberlin and Boks, 2018), changing product design to extend use life (Copper, 2013; Bakker et al., 2014) or to stimulate sustainable consumption patterns (Wever et al., 2008). Further options are the recovery and reuse of materials and components at the end of product life (EMF, 2017) and business model-based approaches, such as product-service systems (PSS) (Tukker, 2004). PSS are believed to decouple raw material input from firm profits through dematerialization of consumption, thereby potentially decreasing negative impacts (Manzini and Vezzoli, 2003). However, strategies for sustainability focused on PSS or design have so far not achieved the aspired sustainability improvements (Tukker et al., 2006).

Some scholars believe that increased consumption equals higher well-being whereas others deem current consumption patterns "environmentally and psychologically damaging" (Jackson, 2005, p. 19). Lorek and Spangenberg (2014) suggested that market and technology-based SC approaches lead to *weak sustainable consumption* and that approaches challenging consumption levels, consumption patterns and the market size lead to *strong sustainable consumption*. Bocken and Short (2016) also saw a need to reduce overall consumption levels and advocated sufficiency as a strategy for SC. They argued that reducing and avoiding consumption offers the largest potential for sustainability. Druckman and Jackson (2010) explored sufficiency earlier through consumer-focused 'reduced consumption scenarios'. The need for SC has been recognized in academia but has not been widely implemented in practice (Mont and Plepys, 2008). One of the challenges for companies is achieving consumer acceptance of sustainable offerings, such as second-hand or remanufactured products (Edbring et al., 2016; Mugge et al., 2017). Overall, the role of companies in achieving SC has been underexplored (Michaelis, 2003; Bocken, 2017) even though companies could become key actors in reducing production and consumption side impacts.

2.2. Circular business models

Business model innovation is understood as a holistic approach to achieve change in companies (Osterwalder et al., 2005; Boons and Lüdeke-Freund, 2013). Osterwalder et al. (2005, p. 3) defined business models as "conceptualization of the way a company does business" in order to "identify the elements and relationships that describe the business a company does". Bocken et al. (2014) identified circular business models ("create value from waste", p. 48) as one archetype of sustainable business models. Circular business strategies have been summarized as "slowing, closing and narrowing" resource loops (Bocken et al., 2016, p. 309). Slowing loops refers to product lifetime extensions and increased utilization and links directly to sustainable consumption. Lewandowski (2016) proposed a business model framework that incorporates circular economy principles and included PSS as a circular business model. PSS are suggested to potentially lead to SC (Mont, 2004).

In circular business model literature, the general emphasis has been on resource efficiency and business model innovation, implemented through strategies, such as reuse, repair, and remanufacture (Bocken et al., 2016; Nussholz, 2017). Circular business models are versatile and tailored to the context and capabilities of the companies (Guldmann, 2016), and often different circular (and linear) business models operate in parallel (Whalen, 2017). A business model can be considered 'fully' circular when upstream and downstream activities are 'circular' (Urbinati et al., 2017). Urbinati et al. (2017) focused on the production side; they see consumers as passive actors who are merely provided with circular offerings and can potentially be informed about their benefits. Similarly, Whalen (2017) and Guldmann (2016) who both reviewed CE business cases, did not explicitly take the consumption side into account.

2.3. Business models for SC in the CE

The CE has increasingly gained attention for its potential to tackle overconsumption and early disposal (Murray et al., 2017), thereby minimizing wasted resources. The right circular business model can help a company achieve economic and environmental sustainability simultaneously (Murray et al., 2017). Edbring et al. (2016) and Mugge et al. (2017) found that consumer acceptance of circular offerings, such as second-hand or remanufactured products, differs greatly between products and customer segments. Bringing together business models and sufficiency, Bocken and Short (2016) proposed 'sufficiency-driven business models' through which companies actively aim to decrease consumption levels. Drawing on prior business model literature (Osterwalder et al., 2005; Richardson, 2008) Bocken and Short (2016) developed a business model framework that includes sustainability aspects. Their sustainable business model framework contains business model elements, such as product/service, customer segments and relationships, and growth strategy/ethos (see Fig. 1). These elements can be used to describe how a business model offers, creates and captures value for a company and other stakeholders. This framework depicts elements of a sustainable business model but does neither consider the transition to the CE as context nor determine business model elements that influence the

Fig. 1. Sustainable business model framework with business model elements, Bocken and Short (2016), based on Osterwalder et al. (2005) and Richardson (2008).

sustainability of consumption.

As outlined in the previous sections, SC is needed in the CE but often not explicitly addressed, and guidance is lacking on how to incorporate CE principles and SC simultaneously. Changes to business models can potentially improve the sustainability of the production side and the consumption side, but it has not been studied how companies' business models could be shaped to lead to SC. This study builds on Bocken and Short's (2016) sustainable business model framework, to explore how business models can help achieve SC in the transition to the CE the following research questions are addressed:

1. What future business models can help achieve sustainable consumption in the transition to the circular economy?
2. Which business model elements are most relevant for sustainable consumption?

3. Methodology

This study applied an iterative, two-round interview set-up with experts that is strongly inspired by the Delphi method. In the following sections, the application of this method is described.

3.1. Delphi-inspired expert study

The research design was inspired by the Delphi method which was developed by the RAND Corporation. The Delphi method is understood to facilitate iterative group communication processes (Hsu and Sandford, 2007), and aims to either reach consensus or nuanced insights (Skulmoski et al., 2007), and enables an exchange of experts in different geographical locations (Rowe and Wright, 1999). The Delphi method can help forecast the development of a specific topic through several rounds of questionnaires with controlled, intermittent feedback (Dalkey and Helmer, 1963). The strength of this method is the objective exploration of issues that concern the future and require personal judgment (Mulder et al., 1996).

A Delphi-inspired approach was selected as it supports the exploratory nature of this study (Skulmoski et al., 2007). Van Dijk (1990) compared the application of questionnaires, group interviews and individual interviews in Delphi studies and concluded that individual interviews have lower drop-out rates, increased involvement and improved quality of answers compared to the other data collection methods. Already in the early days of the Delphi method, the RAND cooperation used interviews alongside questionnaires to clarify aspects and to enrich the data (Dalkey and Helmer, 1963). Following these arguments, we chose a semi-structured interview format to gain in-depth insights (Bryman, and Bell, 2015). This format also allows for follow-up questions and clarifications when necessary to ensure that all diverse experts in the sample interpreted the questions similarly (Bryman and Bell, 2015). We conducted two rounds of individual interviews between April and August 2017. Based on the themes we identified in the first round we developed a framework that was fed back to the experts. During the second interview, experts used the framework to develop future business models. Table 1 provides details of the applied methodology and the outcomes of each step.

3.2. Selection of experts

We assembled a panel with core expertise in the relevant domains and purposefully engaged experts from different sectors (see Table 2) to capture and integrate multiple actors and disciplines and hence perspectives, required to achieve a holistic view of CE (Murray et al., 2017). The panel comprised experts from academia, industry and policy and with expertise in different CE concepts, for example, Cradle to Cradle (McDonough and Braungart, 2002) and The Performance Economy (Stahel, 2010). This diverse panel enabled the exploration of future business models for SC in the CE despite different definitions of the CE (Kirchherr et al., 2017). Identifying the right experts is important as this directly influences the quality of a Delphi study (Hsu and Sandford, 2007; Skulmoski et al., 2007). Experts on either CE, SC, or both fields were identified via known CE business cases, involvement in relevant consulting or policy development, and related academic publications. Subsequently, the panel was extended using the snowball sampling technique (Wohlin, 2014). Experts from industry worked for example in the textile, FMCG, recycling, and manufacturing sectors; and were acting as CEO, designer, consultant, and sustainability director. This panel facilitated the exchange between theory, practice, and policy.

3.3. First interview

The first interview consisted of three parts; first, we explored experts' understanding of CE and SC. Second, experts provided their opinion on how elements of the sustainable business model (Fig. 1) should change in the transition to a CE in order to achieve SC. Third, they formulated the implications of a CE for consumers (see Table 3 for example questions). The interviews were conducted with the 22 experts individually; either in person, via Skype or telephone, and lasted around one hour. The data from the interviews were coded in Nvivo, first according to the questions, then by the specific content to discover themes (Ryan and Bernard, 2003). Four themes were discussed by all experts and contained a variety of different opinions (see Table 4 for coding example). Based on these themes, the set-up of the second interview was developed.

3.4. Second interview

The aim of the second round was to seek consensus on the four themes (i.e. business model elements) and to integrate options of

Table 1
Overview of methodological steps, process and outcomes.

	Purpose	Process	Outcome
Expert selection	Creating a panel of CE and SC experts	Identification via publications, CE case studies, CE related job, then snowball technique, contacted 32 experts	Panel of 22 experts
Interview round 1	Exploratory, discover most relevant business model elements for SC	Semi-structured interviews based on the 11 business model elements	22 interviews provided input for feedback and interview round 2
Analysis round 1	Develop feedback and interview 2 set-up	Coding of interview transcripts for SC	4 business model elements emerged that were developed into a SC business model framework
Feedback	Anonymous exchange of arguments between experts	1 week before the second interview a summary of the round 1 results was sent	Experts could reflect and develop their opinions
Interview round 2	Determine which combinations of business model elements experts deem most promising to achieve SC in the clothing industry	Semi-structured interviews, reaction to framework and questions regarding business models for clothing industry in the present and the future	15 interviews and 23 business model options for the clothing industry based on SC business model framework

Table 2
Sector and expertise of panel experts ('✓' indicates participation in the interview round).

#	Interviewee code	Country	Expertise	Round 1	Round 2
1	Academic 1	Austria	SC	✓	✓
2	Academic 2	Finland	CE & SC	✓	✓
3	Academic 3	Netherlands	CE	✓	✓
4	Academic 4	Netherlands	CE & SC	✓	✓
5	Academic 5	UK	CE & SC	✓	✓
6	Academic 6	Norway	CE & SC	✓	✓
7	Academic 7	Sweden	CE & SC	✓	✓
8	Academic 8	Sweden	SC	✓	
9	Academic 9	Netherlands	SC	✓	✓
10	Academic 10	Switzerland	CE	✓	
11	Practitioner 1	Norway	CE	✓	
12	Practitioner 2	US	SC	✓	✓
13	Practitioner 3	UK	CE	✓	✓
14	Practitioner 4	Netherlands	CE	✓	
15	Practitioner 5	Belgium	CE	✓	
16	Practitioner 6	UK	CE	✓	✓
17	Practitioner 7	Netherlands	CE	✓	✓
18	Practitioner 8	Sweden	CE	✓	✓
19	Practitioner 9	Netherlands	CE	✓	
20	Practitioner 10	Netherlands	CE	✓	✓
21	Practitioner 11	Netherlands	CE	✓	
22	Civil servant 1	Belgium	CE	✓	✓

these into future business models for SC in the clothing industry. The four business model elements were used to develop a framework (Fig. 2) that provides an overview of suggested options for each element and enables mapping of business models for SC. One week prior to the second interview experts received feedback on the first round, including the framework, and one day before the interview the interview structure.

In the second interview, the findings of the first interview were first summarized and agreed upon. This was followed by an explanation of the SC business model framework with an example (Fig. 2). During the first round, it had become clear that discussing business models in abstract terms was difficult and that experts extrapolated the present when asked about the future. The second interview was set-up to follow this thinking process; business models for a specific industry were discussed, first for the present and then for the future. Using the framework experts described the most promising combinations of the four business model elements to achieve sustainability improvements and consumer acceptance for a company in the clothing industry. The clothing industry was selected as current production and consumption practices are highly unsustainable (WRAP, 2012). After mapping future business models, experts were asked to criticize and question the framework.

4. Results

4.1. Results first interview round

The first round of interviews started with the experts' understanding of CE and SC. The majority of experts showed a shared understanding of CE as an economic system within which resources are cycled to achieve economic and environmental benefits. Most experts agreed that a truly circular economy should lead to SC. However, several experts were not convinced that SC would be accomplished through the implementation of CE. These experts either had a critical view on the current implementation of circular business models in practice, questioned the sustainability of the CE concept, or questioned if consumption could ever be sustainable.

Experts then described future specifications of the business model elements in order to achieve sustainable consumption in the circular economy and implications for consumers. The analyses of the interviews revealed four themes that represent business model elements that were mentioned repeatedly but that experts envisaged differently. These four business model elements are *Resource strategy, Revenue model, Consumer effort,* and *Objective for consumption level.* The two business model elements *Resource strategy* and *Revenue model* focus on the production side of a company whereas the elements *Consumer effort* and *Objective for consumption level* bring in the consumption side. These four business model elements are explained in the following sections.

Table 3
Overview interview 1 set-up and questions.

	General topic	Exemplary question (shortened)
Part 1	Understanding of CE and SC	How would you define circular economy and sustainable consumption in one sentence each?
Part 2	Business model elements for SC in transition to CE	How should companies shape their value proposition when implementing circularity and sustainable consumption?
Part 3	Consumers in the CE	Imagine a truly circular economy – how would consumption change? Why?

Table 4
Coding example for the business model element Resource strategy.

Theme	Content groups	Exemplary quotes
Resource strategy	Substitution of non-sustainable materials	"80% of our materials [are] either bio-based or recycled […] everything else is either a virgin plastic material or a petrol-based chemical and we are trying to reduce that. We want all of our materials to be either biodegradable or recyclable." (Practitioner 2)
	Efficiency improvements	"we're […] minimizing resource [use], certainly using them more efficiently and reducing impact that way" (Practitioner 3) "you're also using the detergent more efficiently, you're consuming less energy" (Academic 4)
	Cycling of materials	"products […] are perpetually recycled" (Practitioner 10) "use all the waste materials as the whole materials for industrial production for the second round" (Academic 2)
	Cycling of products and materials	"reuse of the product and recycling [of] materials" (Academic 2) "fleet of assets and then letting customers use that fleet" (Practitioner 6)

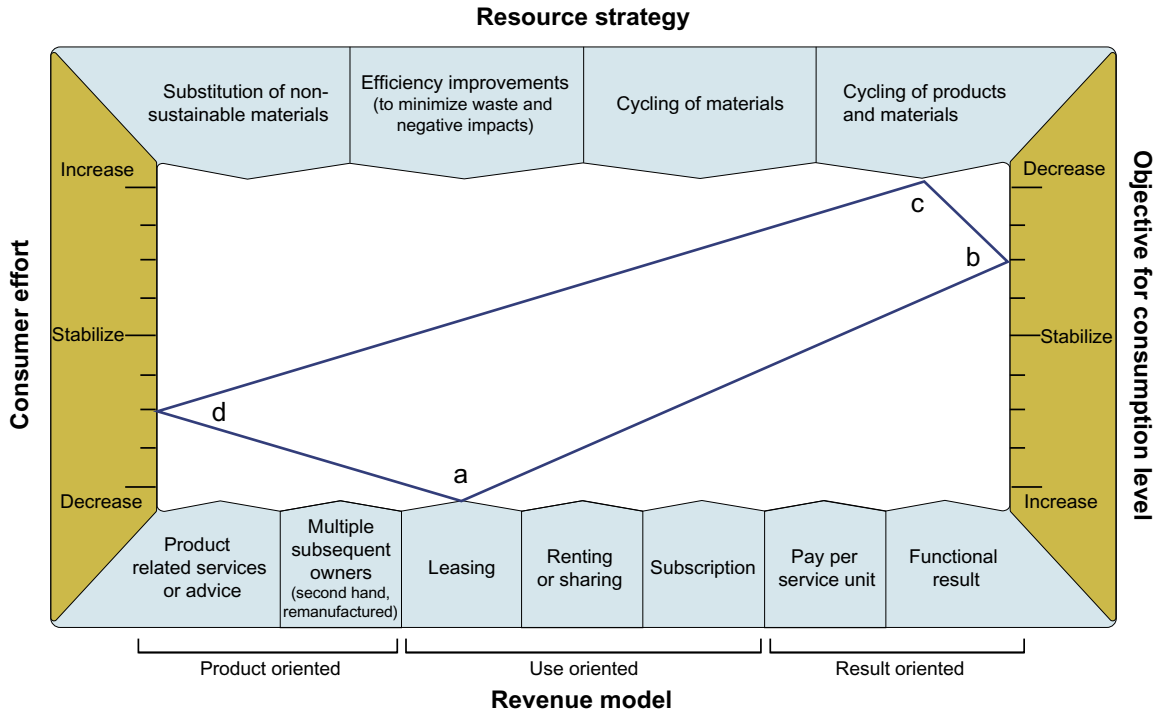

Fig. 2. Business model framework for SC mapping the four business model elements (labelled a-d) for the example of leasing clothes.

4.1.1. Resource strategy

Preventing the waste of resources and excessive virgin material extraction is central to the CE concept as these processes require energy, often resulting in pollution, and increasing competition over scarce materials (Bakker et al., 2014; Zink and Geyer, 2017). Hence, an appropriate resource strategy as input in offerings is highly important to enable SC. The strategies suggested by experts are explained in more detail in the following.

Substitution of non-sustainable materials[1]: Replacement of materials and processes by (more) sustainable ones. Practitioner 2 explained the resource strategy in his company as follows*: "all of our materials are either from bio-based or recycled sources, and all of the packaging we make and all the ingredients for our products are either recyclable or bio-degradable so that you can tie into something like the carbon cycle to renew the materials, that is fundamental in our design thinking."*

Efficiency improvements to minimize waste and negative impacts: Interviewees described process optimization that leads to a decrease in negative environmental impact but not necessarily to circularity; for example, through strategies, such as decreasing raw material use and waste per product and down-cycling of waste. Though this is not truly circular, it is a strategy that was mentioned several times for the transition phase to a circular economy. In the company where Practitioner 3 works, they are "*minimizing resource [use], certainly using them more efficiently and reducing impact that way*".

Cycling of materials: Interviewees described this strategy as a way to reduce the need for virgin raw materials; products are collected after their end-of-life, and the materials are reused for new products. Practitioner 9 envisaged that "*resources will be in a common pool so that they can be used in different types of products by anyone, but they will have to return the resources to that pool after a certain amount of time or put them back into resource circulation*".

Cycling of products and materials: This resource strategy incorporates the same ideas as the previous resource strategy but aims to preserve value through "*reuse of the product and recycling [of] materials*" (Academic 2). For example, second-hand sales, remanufacturing, refurbishing and take-back schemes can facilitate this. Practitioner 2 suggested to "*design the products for either collection and recycling or for multiple uses" and explains that "it is incumbent on industry in cooperation with government to set up a*

[1] Whether a material can be considered sustainable or non-sustainable depends on the context it is applied in. The same material might be sustainable in one context but not in another.

very convenient recycling infrastructure so there is no question in an individuals' mind what can and must be done with substances after it's used once and things simply don't get thrown away."

4.1.2. Revenue model

The revenue model defines how companies monetize their offerings, how consumers can obtain the desired functionality, and who is responsible for means that provide this functionality (Manzini and Vezzoli, 2003). Experts suggested revenue models that are closely related to Tukker's (2004) classification of PSS.

Experts mentioned a range of different revenue models from products to services. Experts suggested product-oriented (*Product related services or advice, Multiple subsequent owners*), use-oriented (*Renting, Leasing, Subscription*) and result-oriented (*Pay per service unit, Functional result*) revenue models. The majority of interviewed experts anticipated a decrease in consumer-owned products. Practitioner 6 stated: "*Ultimately, you will see a move away from ownership of a lot of things. I wouldn't necessarily need to own a number of things as long as I have access to them*". Academic 1 explained why there would be a shift towards services; "*I think it's easier to keep products in a good state when you don't sell them but you lend them or lease them.* The *Multiple subsequent owners* revenue model refers to companies monetizing long-life products through second-hand sales, refurbishment or remanufacturing. Practitioner 6 suggested that "*there's this whole aftermarket creating value, why am I [as manufacturer] not competing in that market somehow?*" The *Subscription* revenue model allows consumers to access offerings when needed for a fixed, regular fee. Some experts envisioned limits for access-based consumption - Practitioner 3 stated that there "*is always going to be an element of ownership for certain things".*

4.1.3. Consumer effort

For a potentially more sustainable offering to achieve sustainability gains it needs to gain consumer acceptance and replace less sustainable alternatives (Zink and Geyer, 2017). Further, for consumers to consume sustainably, actions such as returning or repairing products might be required (Wastling et al., 2018). The consumer effort required for a new, sustainable offering compared to the effort required to consume current standard offerings determines whether a product is more or less convenient.

Interviewees disagreed on the role of consumers in achieving SC. Views ranged from entirely consumer-driven SC, through for example informal sharing, to completely company-driven SC with no changes to the role of consumers. Active roles of consumers were mentioned, for example fixing devices, returning products, using products longer, maintaining them and even changing lifestyles. Academic 9 believed that "*we [the consumers] will be more considerate about which product we buy*", and Academic 10 stated that "*users will have a stewardship relationship with the goods they own*". Academic 6 emphasised the importance of benefits that make potentially higher effort worthwhile: "I might be motivated to return them for recycling or refurbishing if something is in it for me." The other end of the spectrum was described as companies providing sustainable products or services that are convenient for the consumer but require no higher effort or involvement than the equivalent current consumption practices. Academic 7 stated, "*I don't think it is reasonable to rely on people […] to [only] buy from this producer and then you have to drive whatever kilometers to leave this product at this recycling station or at this repair shop. It has to be convenient.*" Practitioner 9 even suggested that "*if you provide people [with] sustainable things to consume, then the consumption will be sustainable*". Practitioner 11 concurred and explained: "*It doesn't necessarily mean that if you do something circular as a supplier or manufacturer that you will change consumption. You can also do it in a way that the people don't even realize it.*" Academic 3 expressed that both ends of the spectrum need to be addressed; "*I think there are people who don't want to become active; they should be enabled as well.*"

4.1.4. Objective for consumption level

The majority of interviewed experts deemed a decrease in consumption levels, also referred to as sufficiency, necessary in order to achieve SC and a CE. A company can actively try to influence consumption levels, for example, through business models that involve shared, long-lasting or upgradable products, increasing their lifetimes or use intensity, thereby decreasing overall consumption levels (Bocken et al., 2016).

Experts talked about companies aiming to change consumer lifestyles and consumption levels: "*you don't want to be encouraging rampant consumption*" (Practitioner 9) but instead support "*reuse, good maintenance, prolonged use […] to keep things longer in the system*" (Academic 6). Several experts talked about the decoupling of consumption and raw material use for example through non-ownership models. Thus, consumption levels could remain stable while the material input decreases. Practitioner 7 believed that "*you don't have to do less, you can even do more, but it is all about being smart in how you create it - how can you gain value or keep it within the loop?*" This expert anticipated that cycling of materials eliminates the need to reduce overall consumption.

4.2. Resulting SC business model framework

During the first interview round, the four themes *Resource strategy, Revenue model, Objective for consumption level* and *Consumer effort* were discussed by all experts, but they did not agree on the specific characteristics. These four themes are business model elements. Based on these, Fig. 2 was developed to visualize the breadth of options suggested by experts. The framework for business models for SC provides an overview of opportunities that can potentially lead to more SC in the transition to the CE. It can be used to map existing businesses and to explore opportunities for future business models for SC. Within this framework, experts combined options of the four business model elements to create business models for SC during the second interview. For a detailed explanation of the business model elements in this framework, please refer to the previous sections. The use and meaning of the figure are explained using a leasing jacket as an example (see Fig. 2). An example from the clothing industry was selected because current clothing consumption practices are unsustainable (WRAP, 2012) but different business models are available and imaginable (Armstrong et al., 2015) and because the second interview round focused on the clothing industry.

Many wardrobes contain a large percentage of clothes that are rarely or never used. These underused clothes represent wasted resources. Leasing models for everyday clothes and rental models for special occasion wear could reduce the amount of idle clothing in wardrobes. For example, a consumer might lease a jacket (a). Paying for the jacket on a monthly basis will ensure that the jacket is sent back once it is no longer needed or desired. This leads to a reduction in consumption as consumers can change the style of jacket from year to year while the previous jacket is used by another consumer thereby *decreasing consumption* (b). The company provides jackets that are durable, easy to repair and recyclable so that they can be *cycled from one consumer to the next* for as long as possible. In this way, the *product and materials are cycled* (c). The jacket is professionally cleaned and repaired after each consumer, can be selected online, and is posted to an address or pick-up location convenient for the consumer and hence requires *less effort* than traditional jacket shopping and owning (d).

The two consumer-focused business model elements (*Consumer effort* and the *Objective for consumption level*) are defined in relation to current standard consumption practices and by their extremes. The line midway (Stabilize) indicates that the *Consumer effort* or the *Objective for consumption level* respectively, stay the same as they are with current standard consumption practices. The extremes of these elements (high/low and decrease/increase) indicate a significant change. In the case of the *Objective for consumption level* element, a mere substitution of another company's product at its end of life is not considered a decrease.

4.3. Results second interview round

The aim of the second interview round was to uncover promising business models for SC. The focus was on the clothing industry because the first interview round showed that it was difficult for experts to talk about business models in abstract terms. Interviewees envisaged and mapped one or two business models for the present and the future in the provided framework. Fig. 3 visualizes the percentage of experts that selected the different options per business model element; experts could select a maximum of two options per business model element. In Table 5 the selected combinations of the four business model elements are summarized.

During the second interview, experts indicated that they deem *Cycling of products and materials* and *Product related services/advice* highly promising as resource strategy and revenue model respectively. Most experts described business models to be implemented now as requiring higher consumer effort and only serving a niche segment. Experts explained that the future business models would serve a larger share of the market as they will be more convenient compared to current standard consumption practices. They explained this decrease of consumer effort with the need to first set-up the infrastructure and the necessity for behavior change now that will be the norm in the future. Most experts agreed that a low consumer effort, thus convenience, would be desirable as this can lower barriers for consumers resulting in wider adoption and larger sustainability improvements. Some experts described a consumer segment that is willing to accept convenience trade-offs for higher sustainability gains. Most experts saw this segment as a small share of the population and hence favored convenient solutions.

The suggested business models were grouped in three categories according to their revenue model; these groups are product oriented (*Product related services/advice, Multiple subsequent owners*), use oriented (*Leasing, Renting or Sharing, Subscription*) and result oriented revenue models (*Pay per service unit, Functional result*). A combination of *Use oriented* revenue models with *Cycling of products and materials* as resource strategy was proposed by six of the 16 interviewees of the second interview round (Table 5). However, 50% of suggested future business models are product oriented and imply that ownership will still be important. Experts believed that use-oriented models support the cycling of materials and products, thereby reducing virgin material inputs.

The comparison of the suggested future business models for the clothing industry did not reveal one or a few preferred business models. Instead, a range of business models emerged, and three of these are exemplarily mapped in Fig. 4. Firstly, despite not reaching an overall consensus, one combination of options from the four business model elements was suggested by three experts independently (Academic 7, Practitioner 2 and Civil servant 1). This business model is mapped with a thick line in Fig. 4. The experts proposed the combination of a *subscription* revenue model with the resource strategy of *Cycling materials and products*, a *lower effort for the consumer* and the *objective to reduce consumption levels*. Experts' suggestions regarding the vertical business model elements varied slightly, but all indicated a decrease in *Consumer effort* and *Consumption levels*. The experts explained that they expect these elements to reinforce each other. All three experts described this business model as aiming for intensified use of the garments. They argued that a clothing subscription could decrease the amount of idle clothes as consumers would return no-longer-used items that subsequently can be sent to another consumer, thereby decreasing the overall consumption level of clothes. Civil servant 1 stated that

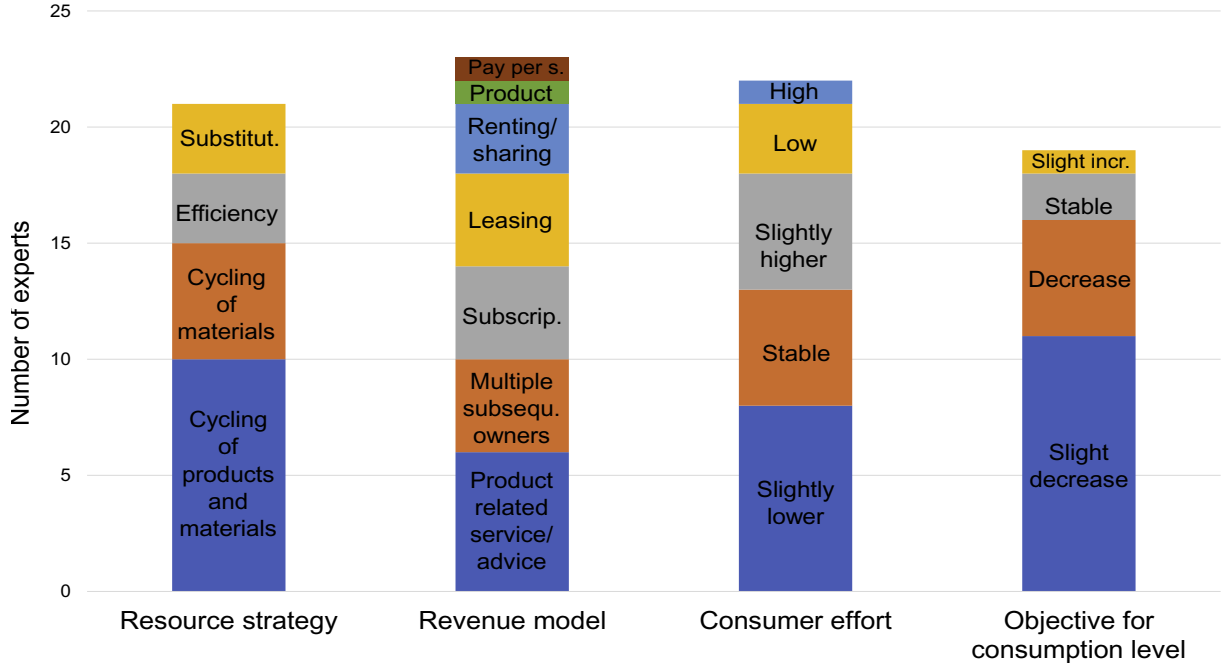

Fig. 3. Number of experts who selected the different options in the framework for future clothing business models (colors used to separate the different options).

Table 5
The numbers indicate how many of the 23 suggested business models combine the different Revenue model options with the different options for Resource strategy, Consumer effort, and Objective for consumption level for envisaged future clothing companies.

Resource / Rev. strat. / model	Substitut. non-sustai. materials	Efficiency	Cycling of materials	Cycling of products & materials	Consumer effort			Objective for consumption level		
					Lower	Stable	Higher	Decr.	Stable	Incr.
Product				1			1		1	
Product relat. services		2	3	1	3	1	2	6		
Multiple subs. owners	1			3	2	1	1	4		
Leasing		1	1	2	2	1	1	2	1	1
Renting or Sharing	1		1	1	1	1	1	2	1	
Subscription	1			3	3	1		4		
Pay per serv.				1	1			1		
Functio. result										
Total	3	3	5	12	12	5	6	19	3	1

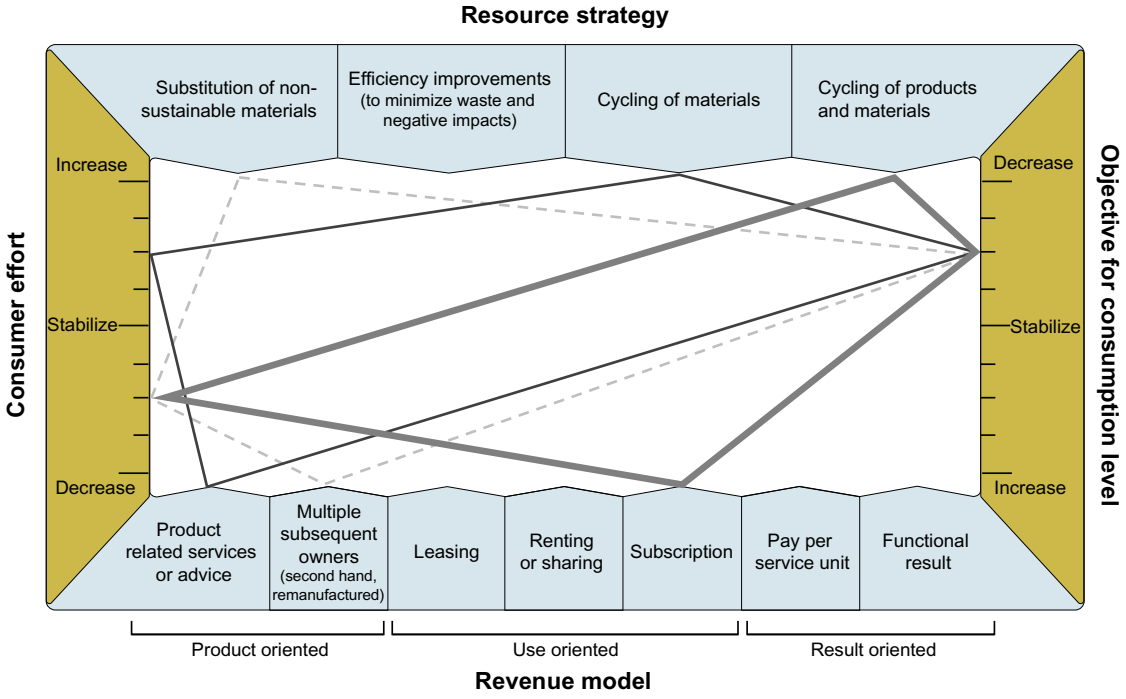

Fig. 4. Business model framework for SC with three examples of proposed future business models.

the non-ownership character of a subscription model would support the cycling of products and materials by taking the responsibility for disposal away from consumers. The expert also envisaged that subscription models would entail convenient return systems through then established reverse logistics processes that would reduce consumers' efforts to consume sustainably.

Practitioner 6 suggested the dotted lined shape, which represents a business model that is built around the idea of using future biodegradable materials. The consumer effort to consume sustainably was described as slightly lower than standard practices as preowned garments could be sold through conventional channels and would be sustainable by design. The interviewee described the garments as high-quality and long-lasting so that they could lead to decreased consumption levels.

Academic 7 proposed the thin lined shape, which represents the business model of an online made-to-fit clothing company. This company creates a range of different designs that are selected by consumers on a website and then realized locally, for example in 3-D print workshops. The interviewee suggested that this offers opportunities for personalization and would thereby better fit the shape and taste of the consumer and potentially be used for longer, hence decreasing consumption levels. This process would also require more time and effort from the consumer than traditional shopping for fast-fashion.

4.4. Reflection on SC business model framework

The SC business model framework was discussed with all experts to develop it further. Some interviewees mentioned that social consideration should be included in the resource strategies, others noted that the framework could include the role of design in achieving SC more explicitly. The four business model elements

required some explanation and they can be interdependent. For example, the choice of revenue model can directly influence the consumer effort and require a specific resource strategy. Some experts expected that the emerging shape inside the framework indicates the level of SC that the developed business model achieves. Based on the wide consensus on the 'decrease' side on the *Objective for consumption level* this element could be changed, for instance, by providing different levels of decrease that might depend on the industry or even the specific offering (e.g. use frequency, replacement frequency). Overall, the interviewees found the framework useful to map current businesses and to think about future business models for SC.

5. Discussion and conclusion

In this study, we applied a two-round, Delphi-inspired approach through interviews. During the first interview round, based on Bocken and Short's (2016) sustainable business model framework, four business model elements that are important for SC were identified; namely *Resource strategy, Revenue model, Consumer effort,* and *Objective for consumption level*. The framework for SC business models comprises these elements and was used by experts to develop SC business models during the second interview round. A variety of different SC business models for the clothing industry emerged.

5.1. Discussion

This paper proposes a business model framework for SC that includes production and consumption side aspects of a business model that can help achieve SC. With this, we propose a step towards Mont and Plepys (2008, p. 536) who voiced a need for strategies that "target both the supply and demand sides". This research highlights the importance of considering the consumer who is often neglected in CE discussions that largely focus on material and product flows (Edbring et al., 2016; Murray et al., 2017). Further, it demonstrated that PSS (Manzini and Vezzoli, 2003; Tukker, 2004) could potentially become more sustainable if companies that implement them change the *Resource strategy, Consumer effort,* and *Objective for consumption level* of their business models with SC in mind.

This research suggests that a wide range of different business models for SC could be promising in terms of sustainability and consumer acceptance. This confirms findings of Mugge et al. (2017) who identified several customer segments with different requirements for refurbished smartphone offerings in their research and research conducted by Edbring et al. (2016) who discovered that different types of furniture require different SC strategies. It appears that the finding of the sustainability potential of coexisting, diverse offerings is applicable across different industries.

Concurring with Bocken and Short (2016) the interviewed experts expressed that SC business models should decrease consumption levels. The business model elements identified in this study link to four business elements from Bocken and Short's (2016) framework; namely to Customer segments and relationships, Resources, Cost structure & revenue streams, and Growth strategy/ethos (see Fig. 1). Building on their framework and the first round of interviews we developed a framework for SC business model that allows focussing specifically on improving the sustainability of consumption in the CE context. It might be beneficial to use both frameworks in parallel to improve the sustainability of consumption whilst not losing track of other important business model elements.

We expected that interviewees, due to their CE and SC expertise, would describe visionary business models that could potentially lead to strong sustainable consumption. However, the proposed business models aim to slightly decrease consumption levels while being convenient for consumers, thus relating to weak sustainable consumption (Lorek and Spangenberg, 2014). This shows that radical change to businesses, which could lead to strong sustainable consumption, is difficult to imagine even for experts in the field. This could originate in the assumption that striving for strong sustainable consumption traditional contradicts growth objectives. However, Bocken and Short (2016) and Wells (2016) have presented some best practice examples.

In recent years, most studies applying the Delphi method used questionnaires to gather opinions but also interviews have been suggested and used (Van Dijk, 1990; Allwood et al., 2008). To support the exploratory nature of this study and enable the integration of different knowledge domains we designed a methodology based on principles of the Delphi method; conducting several interview rounds, intermittent feedback and preserving the anonymity of experts. The applied Delphi-inspired method is based on two rounds of semi-structured interviews, the second round being supported by a framework based on the results of the first interview round. The use of this methodology led to rich insights into this complex topic and a solution space for business models for sustainable consumption in the circular economy.

The applied qualitative methodology entails some limitations; the study is based on the subjective opinions of experts who developed business models that match their vision of a future circular economy. The use of a relatively small sample, the subjective nature of the data and a focus on one industry only (in the second round), imply that not all findings are applicable to other industries. However, high-level findings, such as the benefits of a variety of business models, the importance of consumer effort and consumption reduction, can probably be generalized. Some industries might require major technological innovations to achieve SC and to become circular.

In this study, we focused on the business to consumer market as products and services, such as clothing, were more tangible for participants. However, our framework is likely to be also applicable for B2B business models; for example, the effort a firm or an end-user at a firm has to invest to use a product or service is at least as relevant for adoption as it is for consumers. This framework and possible adjustments thereof for the business to business context could be explored in the future. Further, financial aspects of business models could not be considered as these would be highly context-dependent and hypothetical. Future research could explore financial aspects. It could also investigate the applicability of the proposed framework to different industries and test the viability of proposed business models in practice. Further research could also evaluate actual sustainability gains and potential changes to consumption patterns through business models developed within the proposed framework, which could be mitigated by rebound effects (Zink and Geyer, 2017). Further, it would be interesting to build on this study and explore business opportunities enabling strong sustainable consumption (Lorek and Spangenberg, 2014).

5.2. Conclusion

This research aimed to reveal potential business models for SC in the context of the CE transition. To date, CE and SC have mostly been studied separately. We sought to combine these topics by developing future SC business models for the CE transition. Based on our findings we developed a business model framework that can be used by practitioners and academics alike to map current offerings, and to develop future business models that incorporate SC. This framework can support SC-focused discussions of business models, as it highlights a range of options to improve SC. During the

second interview round, experts mapped a wide variety of business models for the clothing industry on the four business model elements in the framework and outlined different customer segments and contexts of use.

This study suggests that a variety of business models is most promising to achieve SC in the transition to the CE as they allow consumers to choose the offering that best matches their personal needs and preferences. Sustainable offerings that require little effort of consumers would probably be adopted by more people. Combining a convenient offering with a matching revenue model, and an objective to decrease consumption levels along with a matching resource strategy, can increase SC levels. The findings of this research confirm that changes to business models are needed to transform current unsustainable consumption patterns (Bocken, 2017) and offers a framework to develop business models for SC.

We explored SC business models in the context of the CE transition, thereby contributing to existing literature of these fields (e.g. Mont and Plepys, 2008; Boons and Lüdeke-Freund, 2013), and to practice by providing a framework for the analysis and development of business models for SC. This study shows that SC can be integrated into business models and provides a framework that can support doing this. Implementing SC business models to stimulate SC on the production and consumption side is an important step towards a more sustainable society.

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